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IO'S VOLCANIC ACTIVITY: NEW RESULTS FROM GALILEO'S NEAR-INFRARED MAPPING SPECTROMETER

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The Near-Infrared Mapping Spectrometer (NIMS) on Galileo observed Io during the spacecraft's latest two encounters with this moon, on August 2001 (I31) and October 2001 (I32). The spectral range of NIMS (0.7 to 5.2 microns) allows the instrument to map the thermal emission from Io's many volcanic regions, and the surface distribution of SO₂ and of a yet-unidentified compound that absorbs near 1 micron. Band ratio and thermal maps were obtained for several volcanically active regions and results compared with those from observations obtained in the earlier fly-bys of October 1999 (I24), November 1999 (I25) and February 2000 (I27). The latest observations show significant changes at the Tvashtar volcanic region, which was first observed as active during I25. The locations active during I25 and I27 still show thermal emission, most likely from cooling flows, but renewed activity took place at a third location. Other areas in this chain of calderas also show thermal emission, indicating that the region is a particularly active one on Io. Tvashtar is located at about 63 degrees north latitude and may be one of the few active areas at high latitudes. A regional observation at 22–34 km/pixel of Io's disk from north to south polar regions obtained in I31 indicates that volcanic activity may be relatively rare at high latitudes compared to the equatorial and mid-latitudes. This confirms previous suggestions about the global distribution of hot spots on Io from NIMS observations at lower spatial resolution (of the order of 200–400 km/pixel), and also from imaging data. We will present results on the global distribution of volcanic activity, and on individual volcanic centers targeted during the fly-by, including the Amirani/Maui region, Prometheus, and Pele. Prometheus and Amirani show similar styles of activity: long lava flows that, in the case of Prometheus, feed a persistent plume. The plume reported by Voyager (but not Galileo) at Maui may have been the result of the interaction of a lava flow that runs from Amirani toward Maui, but which is no longer active. Small-scale changes at several active volcanic centers are assessed by comparing the latest observations (2001) with those obtained in 1999 and 2000. We also report results on regions not previously observed at high spatial resolution by NIMS, including Gish Bar and Isum. High spatial resolution observations obtained during the fly-bys show that the structure of these hot spots is more complex than thought from distant observations and that hot spots are often made up of more than one volcanic center. Galileo observations have shown that Io's surface is dotted with many active volcanic centers, concentrated at low and mid-latitudes, separated by plains where SO₂ is being continuously deposited.